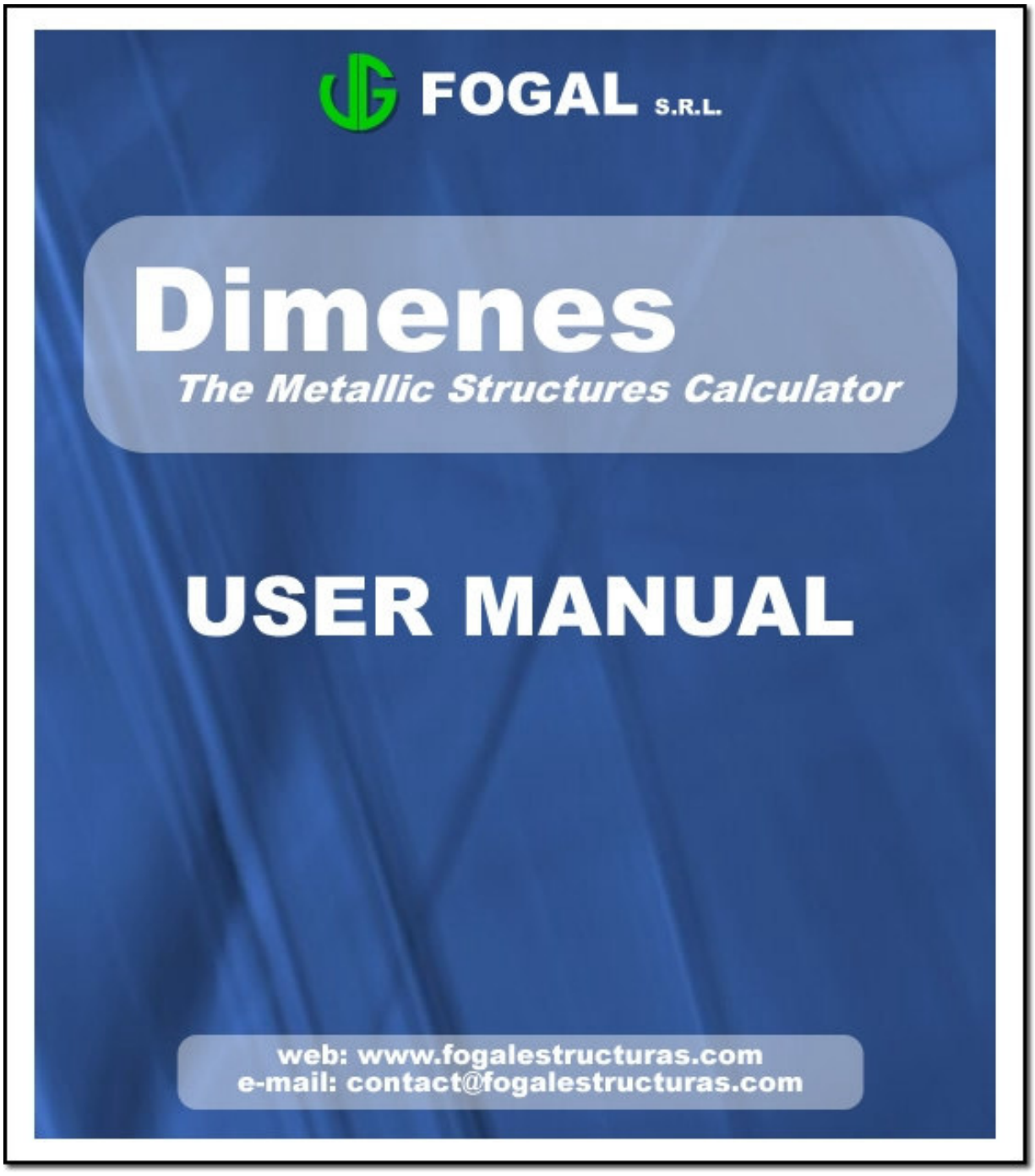


Dimenes
Version 1.5

User's Manual

Novelties of Version 1.5 rf: Profiles IPE, HE-A and 540 types of Welded plates I sections, are introduced for calculation. The function of FORCE HEIGHT was added for these sections (look at the frequent questions). Examples of ALL THE SECTIONS AVAILABLE IN THE PROGRAM can be loaded now. These examples are installed with the program Dimenes. You will find them at the directory where you installed Dimenes, in the folder Examples.
You can load them by clicking LOAD in the main screen of the program.

Index

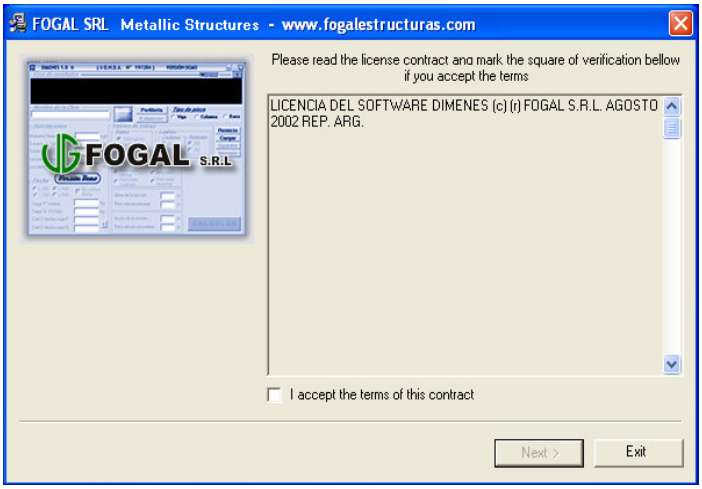
1) System requirements to install Dimenes

To install Dimenes, it is necessary that your computer fulfills the following minimum requirements:
Processor: 486 or higher
Platform: Windows 95/98/Millenium or Windows NT 4.0 / 2000 / XP
Hard Disk: 5 Mbytes free space in the hard disk.

2) Installing the DEMO version

Once the program is downloaded from our web site or logging in from the CD ROM (in case you have purchased it in a CD ROM support) you have to double-click on the INSTALL.EXE file.

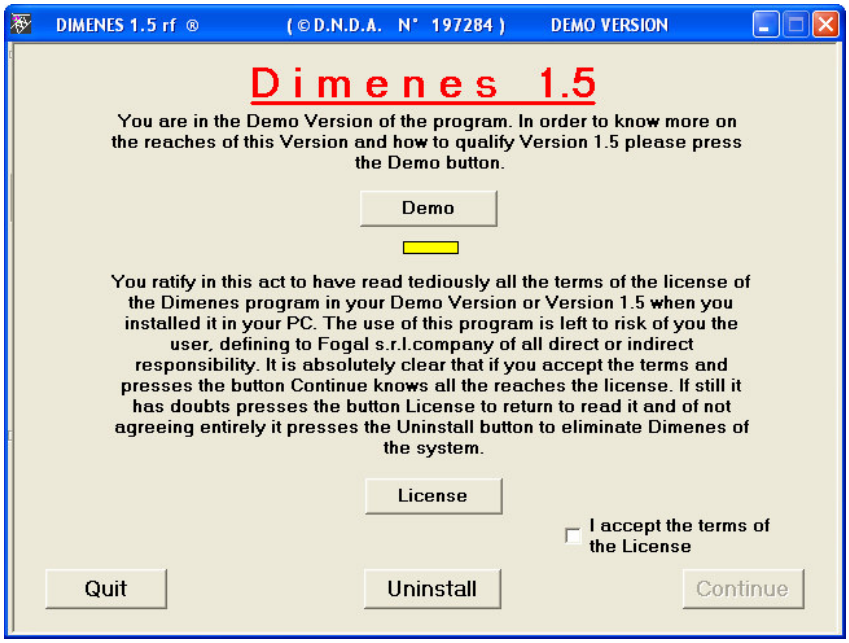
Then to install it, you have to accept the terms of the license contract, so the following button will be enabled. To continue the installation you have to click on the button *next* and continue the installation step by step.



Uninstalling: To uninstall Dimenes you have to go to the *Start* > *Programs*> *Dimenes*> *Uninstall* button. When the question' 'Are *you sure you want to uninstall Dimenes"*? appears, you must answer clicking the button' 'YES' The program will begin to uninstall itself automatically.
Note: Dimenes can be reinstalled whenever it is not already installed. Besides, to uninstall it Now you have to accept the license choosing the option 'I Accept the terms". Doing it the button Continue will be automatically enabled. Clicking on this button you will enter to Dimenes in the demonstration mode. You can check if it is operating in demo version looking at the indicator detailed in the next screen:

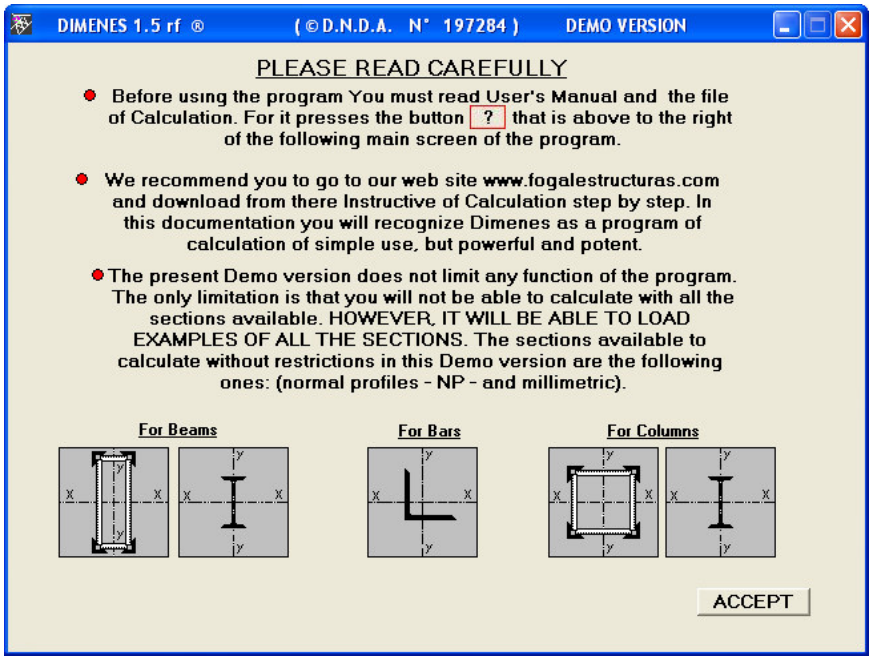
3) Executing the DEMO version

To execute the software you should go to Start> Program> Dimenes button and then click with the mouse in Dimenes. In this step, a screen with information about the license will be presented to you:



In this step you have to accept the license by choosing the option ” I Accept the terms". Doing it the button Continue will be automatically enabled. Clicking on this button you will enter to Dimenes in the demonstration mode. You will be able to check if it is operating in demo version by looking the indicator detailed at the next screen:

During the operation in the demo version, you will be able to operate with a limited range of sections. To operate with the complete range of sections, you have to register the software. You will be able to see the admitted sections without limitations in the Demo version in the following screen.



4) Registering Dimenes
To register the software, you have to click on the button' 'Demo Version."

Clicking on it you will get a number that will register your PC and later the whole program.

With this number you will have to enter to our Web site and, after choosing and completing the payment mode and the registration form (where this number will be requested to you) you will get the ' Authorization of Use Code ' This code will be sent to you with the chosen payment mode corresponding delay. This delay will be immediately notified to you, to the e-mail you informed, together with the corroboration of your order.

REMEMBER:

That this' Authorization of Use Code' is SELECTIVE AND WILL ENABLE THE COMPLETE PROGRAM CORRECTLY ONLY in the PC where you installed the Demo Version and asked for the registration.
THIS MEANS: Try the Demo Version in the computer you want, BUT GET THE REGISTRATION NUMBER that will enable you to buy the license, IN THE PC WHERE YOU WILL USE THE COMPLETE VERSION. (please read the license contract where it is exposed your right to get the' Authorization of Use Code' free of charge if you change your PC or operating system compatible with Dimenes). That you will be in the future identified to us with this' Authorization of Use Code' for any requirement, SO YOU HAVE TO KEEP IT IN A SAFE PLACE. If you forget it, enter into our Web site and follow the FORGETFULNESS OF CODE steps.

That a badly enabled Demo Version will produce errors, even randomly. Licenses for Complete Versions don't EXIST. Fogal s.r.l. always ENABLES DEMO VERSIONS. The registration always guarantees you our total support and that an illegal copy will always work deficiently and randomly. Besides, to register also has always the benefit of obtaining future versions of Dimenes or other programs at preferential prices.

If you want to acquire more than one program for other machines registered under YOUR NAME, you will get important discounts.

To register Dimenes, complete the form in our web site :

http://www.fogalestructuras.com

Note: If by any reason you enter any registration number and then click on the button "Register", the program will indicate you that, this way, the values you will get are incorrect, since the program is being executed in an incorrect way of operation. You will be able to check this incorrect way through the following indicator:

To return to the Demonstration mode, you will have to close and execute the program again.

5) Benefits of registering Dimenes

If you decide to get the license of the whole version, you will have access to a powerful and easy to use calculation program of metallic structures, but also to all the experience of a company that has built thousands of square meters and with more than 30 years of uninterrupted activity in the country together with other free benefits, as detailed below:

1) By e-mail: You will have a help desk of the operation and techniques of the program. (Answers will not be given to the questions that are inside the FREQUENT QUESTIONS in the User's Manual that is installed together with the program in three formats: Text, word document, and pdf).

2) By e-mail (and up to 3 monthly consultations) Orientation and help to calculate any metallic piece. From the determination of efforts up to the resulting piece (simple pieces or simple gantries). You will be able to attach any calculation 'XXX.nes' file generated by Dimenes attached to your consultation, so we will be able to send you another file with the corrections. REMEMBER that Dimenes generates compatible files under any regional configuration that uses' comma' or' dot' as decimal separator, this doesn't hinder in any way its exchange.
(VALID ONLY FOR ARGENTINA).

3) Technical advice: For metallic structures to be executed or that are in execution project (with limited scope to our availability and in the Argentinean Republic).

6) General description of Dimenes

Dimenes is a program useful to size metallic structures, for the cases most commonly presented to the user. It is basically a calculator of sections of beam, columns and bars, with quick comparison between different solutions and qualitative and quantitative computation of materials.
Its use is prepared for **Architects, Engineers, Master Builders, Technicians Manufacturers, Building Companies, Metallic Construction Companies, Students,** etc.
Its simple use, even with basic knowledge, makes it indispensable to get to the best results with maximum utilization of the materials.

The charts of profiles correspond to american STEEL sections, whether Normal and folded plate sections. With these sections (that can be replaced at the users order for others commonly used in their region) you can obtain composite pieces of up to approximately 290 Kg per lineal meter -of own weight of the piece-, which give an idea of the usage area.
The used calculations Standards are DIN. (Germany), CIRSOC (Argentina) and MV-UNE-NBE (Spain) in all that concerns to Metallic Structures. (Other Standards will be added hereafter)

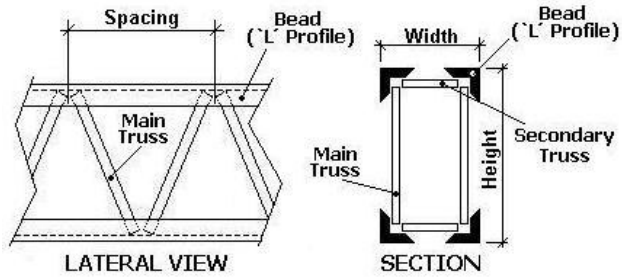
When clicking the button STEEL Type, it is possible to alternate between different STEEL standards. Each STEEL type option in each standard will register the maximum values of admissible working sigmas that appear automatically in Sigmas.

The deformation deflection coefficients (k) correspond to the beam type that you calculate (with an elasticity module of 2.100.000 kg/cm2).

For example k = 6,2 for freely supported beams with uniformly distributed load and k = 9,921 for freely supported beams with a central concentrated load.

These coefficients can be obtained from the different Standards, and many of them are provided by the author in THE USER'S MANUAL in the complete version of the program.

The data to introduce in the loads and deflections will be the previously calculated by the user. For the beam dimensions, it shall be kept in mind that the height and width of the section (as selected) will always be those of external sides.
At the same time, the spacing of the trusses will be taken between axes of clusters (look at figure 1). The measuring button will not be enabled until all the data are completed.



7) Limitations of the Dimenes DEMO version

The version DEMO allows you to use all the program characteristics, only restricting the quantity of sections for calculation.

8) Description of the software screens.

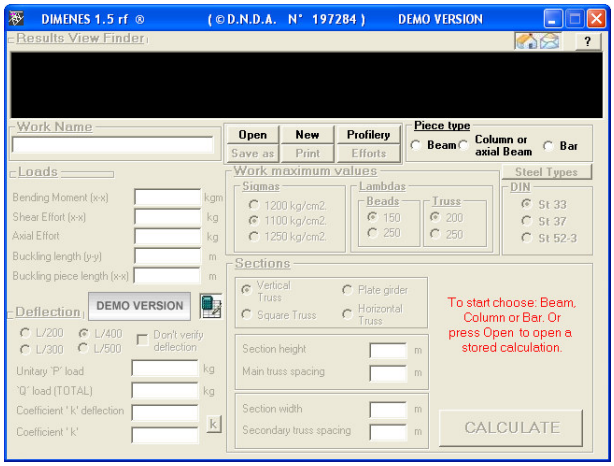
Main screen:

When putting the pointer anywhere on the Main Screen appears an explanatory reference text of each part.

If you have Windows with the regional configuration to work with decimals separated with dots, the program will automatically work with dots and won't allow the entering of commas. In case your configuration is with comma, the software will automatically work with commas and it won't allow the entering of dots.

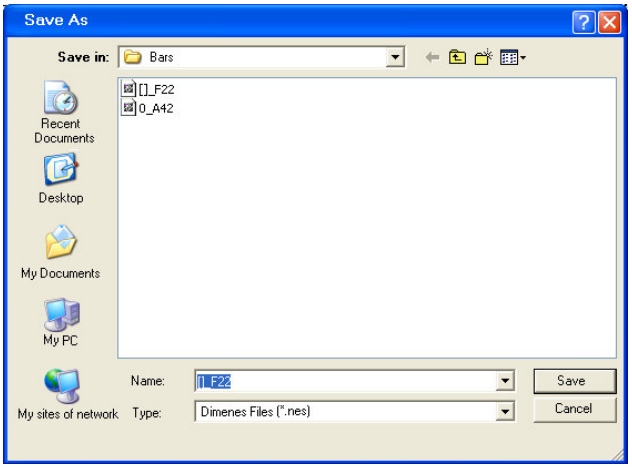
To begin a calculation you have to choose a type of piece Beam - Column – bar.

Then you can begin to operate the button Effort for the typical pieces or enter the data directly into the fields (there are not limits on this)



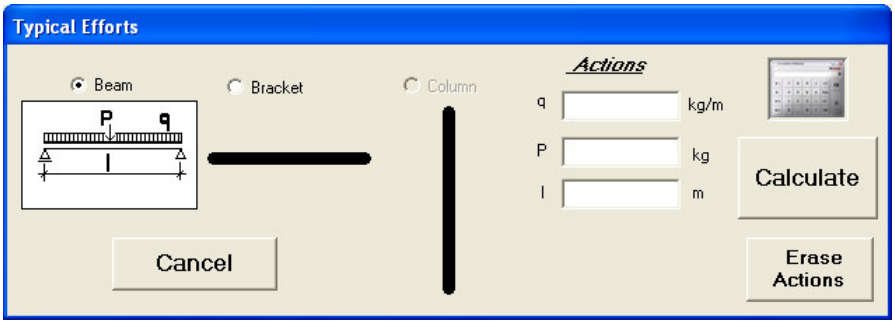
Save Screen

It allows saving the finished calculation with the assigned file name.



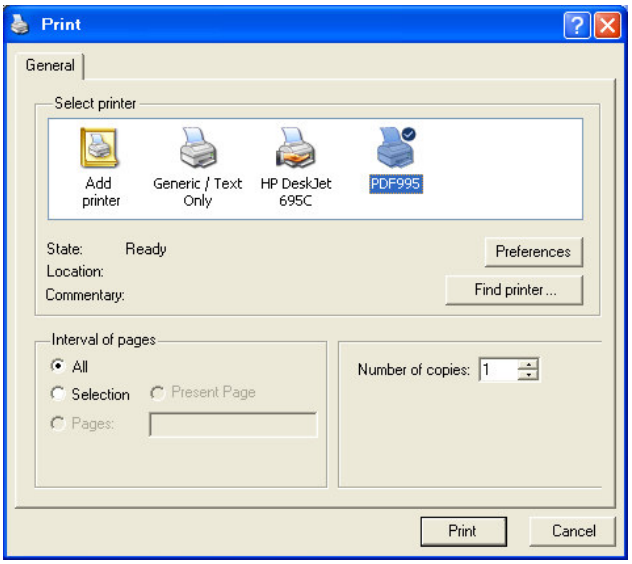
Typical Efforts Screen

From the main screen, choose *beam or column*. This enables in typical efforts, *beam or bracket* in the first case and *column* in the second. The data are introduced into the boxes, then click on calculate and the loads appear in the main screen.



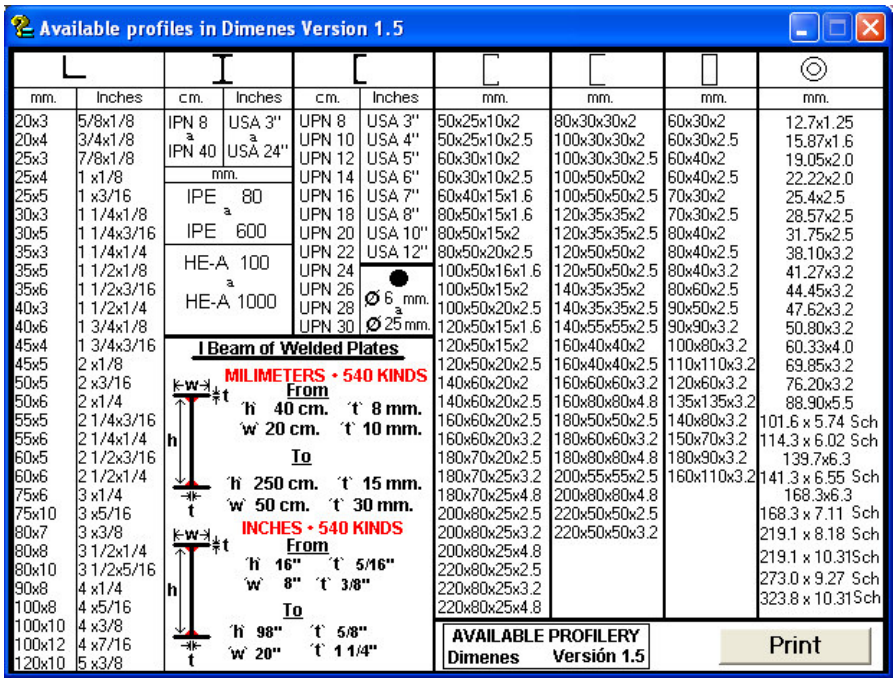
Printing Screen

Prints the main screen together with the finished calculations



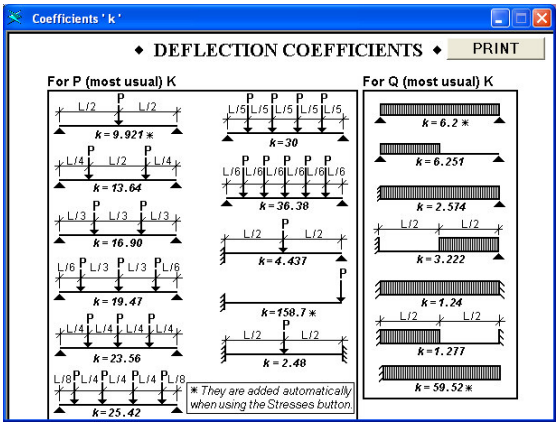
Profiles Screen

Available database with which Dimenes operates



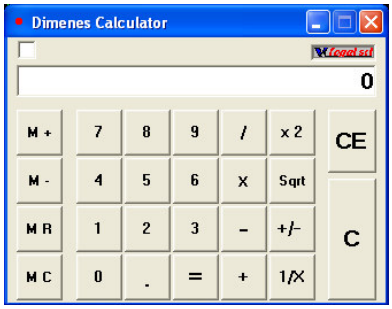
Deflection coefficients K

Most frequently used 'K' coefficients.



Calculator Screen

It operates simultaneously with the Main Screen.



9) Frequent questions about how Dimenes operates:

a) What is *DIMENES* used for?

It is used as a calculator to calculate metallic pieces with quick comparison of different sections, and qualitative and quantitative computation of materials.

b) What scope has *DIMENES*?

Pieces which weight up to approximately 290 kg per lineal meter -of own weight of the piece-, if the calculation compounds the piece with the highest sections from the Profiles chart. For example, a beam 30 m long, with uniform loads of 600 kg/m and a 3 000 kg concentrated load in the center of the girder span, gave results of pieces weighing up to 200 kg / ml, that is to say a total weight of the beam of 6000 kg.

c) What *Standards* are applied in the program?
They are selected by clicking the STEEL Type button

DIN Standards (Deustcher Industrie Normen), the CIRSOC Standards (Civil Works National Security Regulations Investigation Center) and the Standards MV-UNE-NBE, German, Argentineans and Spanish respectively are applied.

NOTE: Other Standards will be added in future versions.

KEEP IN MIND THAT, WHEN CHOOSING SECTIONS, DIMENES DOES NOT DIFFERENTIATE THE STEEL TYPE OR STANDARD TO BE USED, SO THE USER SHOULD DETERMINE THEM TOGETHER WITH THE VALUES OF THE WORKING SIGMAS FOR THE STEEL TYPE(S) THAT COMPOSE THAT SECTION.

d) With what *numeric system* does it operate?

It operates with the Decimal Metric System separating the decimals with dot or comma, according to the regional configuration which is used to work with. (It is automatic for the program)

e) What is the button *Effort* used for?

The button Effort opens a box to introduce loads to different pieces excepting bars and according to the initially chosen piece type.

f) Why are there 2 values of *Lambda* for beams and 2 for trusses?

The value 150 in beams and 200 in trusses are for bridges (dynamic loads); 250 in beams and 250 in trusses are for buildings (static loads).

g) Why are there 3 values of *Sigma*?

The value of 1400Kg/cm.2 is for cases of load H. (Dead weight + permanent overloads). The value 1600Kg./cm.2 is for cases of load HZ. (Dead weight + transient overloads)
(E.g.: wind-STEEL St.37 DIN Standards). The value 1200Kg./cm.2 is in case of using demolition STEEL. The admissible shear efforts don't appear on screen but are taken related with the chosen Sigma.

h) In what cases do the sections consider *Shear Stress* as such?

In plate core girders, *columns and beams* (they appear in the results view finder and are integrated to the piece sizing).

i) What *deflection* coefficients should be introduced?

Those that correspond to each load case and linking of piece supports. Look at the most usual values clicking the *k button* on the main screen. Those pieces of the Effort box are introduced automatically.

j) Why the upper and lower *beams* of the calculated combined pieces are equal?

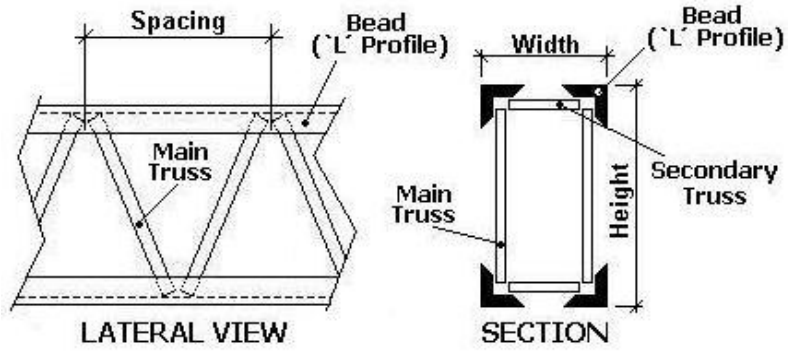
Because they are symmetric pieces, in which a reversal of loads of the same magnitude can happen.

k) What type of *main and secondary Trusses* are considered?

They are considered forming Zigzag.

l) How are the section *Height and Width, and Trussed Spacing* measured?

The height and width of the section are the distances between sections external edges and the truss spacing is the distance between clusters.

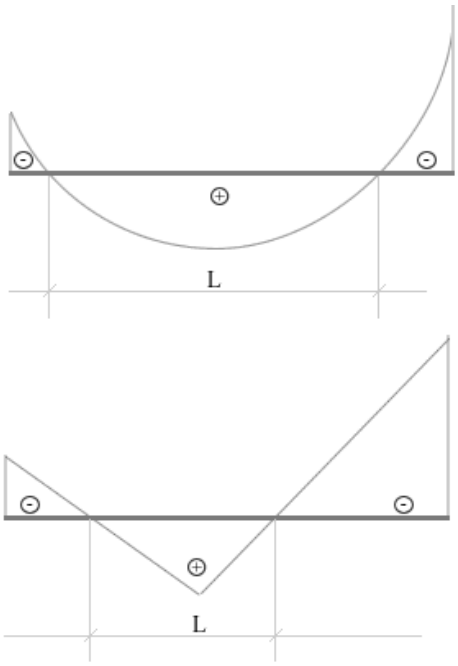


m) Does the results View Finder include *previously estimated Dead weight of* the piece?
It doesn't include it, to obtain it approximately it is necessary to make two calculations, and add to the loads of the second one the dead weight of the piece obtained in the first one.
n) What is inertia moment (*J x-x*) the piece, that appears in the Results View Finder used for?
It is used for the previous sizing of the parts of a complex structure (gantry, continuous beam, etc.). And then, introducing it into the definitive calculation.
o) How is the *Screen enabled* to begin a calculation?
By marking the piece type to be calculated or loading a saved file.
p) What should I do to calculate a bar to *traction* stresses?
I have to take the **Girder span y-y** and the **Girder span x-x** to zero (0).
q) What are the *New, Open and Save as* buttons used for?
The ***New*** button is used to erase a previous operation and begin a new calculation; the ***Open*** button is used to bring back a saved calculation file. And the ***Save as*** button, is used to save the finished calculation.
r) What is *Click used for in the Section*?
It's used to rotate and choose different usual sections. These sections are different according to the election made in the Section sector of the adopted generic type. Besides, in the composed sections you can introduce at will any piece width and/or height.
s) What sections does *Profiles* contain?
It contains the usual commercial STEEL sections, with which Dimenes works.
t) Can I calculate a section with *sections in mm. and trusses in inches*?
Yes, calculate the section in mm, then calculate another of equal dimensions and loads but in inches, then replace the trusses of the first one with the trusses of second one. You will have worthless differences in **stresses**. The same for the reverse case.
u) ¿How do you calculate when de' USA' booth is ticked?
It calculates sections with profiles in inches by defaults. Completes with millimetric profiles if they don't exist in inches for the type of selected piece. If this booth is not ticked, it calculates by default the whole section with millimetric profiles.
v) What is the 'Activate heights' option used for when the I Welded section is chosen?
If this box is not enabled, Dimenes **will find the lighter profile** that can find to satisfy the loads. Although it is the most suitable profile, it is possible to find another with a different height so that it adapts better to the project. Consequently, if the booth is enabled, 23 heights will appear; in inches if the USA booth is enabled or in centimeters if it is not. There, a height different to that of the best weight profile can be chosen, and if it doesn't verify some of them, Dimenes will inform why in a message.

10) Tricks and suggestions

a) How can I calculate a beam with *axial efforts*?
Calculating it as column but with the limitation it is not possible to calculate the deflection.

b) How can I calculate the deflection in beams with moments of different sign, that don't appear in the k. chart?
By taking the section L and calculating it as a freely supported beam with the loads of that part.



CHARTS OF BUCKLING COEFFICIENTS FOR THE USED STEELS
(the Sigmas refer to admissible working values and under conditions of safer use)
Generic: Admissible shear stress for STEELS of 1200 kg/cm2 = 800 Kg/cm2

STEEL St 33 - St 37

Working sigmas 1100 y 1250 Kg/cm2 1400 y 1600 Kg/cm2 Admissible Shear Stress 708 y 821 – 900 y 1050 Kg/cm2

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1,04	1,04	1,04	1,05	1,05	1,06	1,06	1,07	1,07	1,08	**20**
30	1,08	1,09	1,09	1,10	1,10	1,11	1,11	1,12	1,13	1,13	**30**
40	1,14	1,14	1,15	1,16	1,16	1,17	1,18	1,19	1,19	1,20	**40**
50	1,21	1,22	1,23	1,23	1,24	1,25	1,26	1,27	1,28	1,29	**50**
60	1,30	1,31	1,32	1,33	1,34	1,35	1,36	1,37	1,39	1,40	**60**
70	1,41	1,42	1,44	1,45	1,46	1,48	1,49	1,50	1,52	1,53	**70**
80	1,55	1,56	1,58	1,59	1,61	1,62	1,64	1,66	1,68	1,69	**80**
90	1,71	1,73	1,74	1,76	1,78	1,80	1,82	1,84	1,86	1,88	**90**
100	1,90	1,92	1,94	1,96	1,98	2,00	2,02	2,05	2,07	2,09	**100**
110	2,11	2,14	2,16	2,18	2,21	2,23	2,27	2,31	2,35	2,39	**110**
120	2,43	2,47	2,51	2,55	2,60	2,64	2,68	2,72	2,77	2,81	**120**
130	2,85	2,90	2,94	2,99	3,03	3,08	3,12	3,17	3,22	3,26	**130**
140	3,31	3,36	3,41	3,45	3,50	3,55	3,60	3,65	3,70	3,75	**140**
150	3,80	3,85	3,90	3,95	4,00	4,06	4,11	4,16	4,22	4,27	**150**
160	4,32	4,38	4,43	4,49	4,54	4,60	4,65	4,71	4,77	4,82	**160**
170	4,88	4,94	5,00	5,05	5,11	5,17	5,23	5,29	5,35	5,41	**170**
180	5,47	5,53	5,59	5,66	5,72	5,78	5,84	5,91	5,97	6,03	**180**
190	6,10	6,16	6,23	6,29	6,36	6,42	6,49	6,55	6,62	6,69	**190**
200	6,75	6,82	6,89	6,96	7,03	7,10	7,17	7,24	7,31	7,38	**200**
210	7,45	7,52	7,59	7,66	7,73	7,81	7,88	7,95	8,03	8,10	**210**
220	8,17	8,25	8,32	8,40	8,47	8,55	8,63	8,70	8,78	8,86	**220**
230	8,93	9,01	9,09	9,17	9,25	9,33	9,41	9,49	9,57	9,65	**230**
240	9,73	9,81	9,89	9,97	10,05	10,14	10,22	10,30	10,39	10,47	**240**
250	10,55										**250**

STEEL St 52-3

Working sigmas 2100 y 2400 Kg/cm2 Admissible Shear Stress 1350 y 1575 Kg/cm2

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1,06	1,04	1,04	1,05	1,05	1,06	1,06	1,07	1,07	1,08	**20**
30	1,11	1,09	1,09	1,10	1,10	1,11	1,11	1,12	1,13	1,13	**30**
40	1,19	1,14	1,15	1,16	1,16	1,17	1,18	1,19	1,19	1,20	**40**
50	1,28	1,22	1,23	1,23	1,24	1,25	1,26	1,27	1,28	1,29	**50**
60	1,30	1,31	1,32	1,33	1,34	1,35	1,36	1,37	1,39	1,40	**60**
70	1,41	1,42	1,44	1,45	1,46	1,48	1,49	1,50	1,52	1,53	**70**
80	1,55	1,56	1,58	1,59	1,61	1,62	1,64	1,66	1,68	1,69	**80**
90	1,71	1,73	1,74	1,76	1,78	1,80	1,82	1,84	1,86	1,88	**90**
100	1,90	1,92	1,94	1,96	1,98	2,00	2,02	2,05	2,07	2,09	**100**
110	2,11	2,14	2,16	2,18	2,21	2,23	2,27	2,31	2,35	2,39	**110**
120	2,43	2,47	2,51	2,55	2,60	2,64	2,68	2,72	2,77	2,81	**120**
130	2,85	2,90	2,94	2,99	3,03	3,08	3,12	3,17	3,22	3,26	**130**
140	3,31	3,36	3,41	3,45	3,50	3,55	3,60	3,65	3,70	3,75	**140**
150	3,80	3,85	3,90	3,95	4,00	4,06	4,11	4,16	4,22	4,27	**150**
160	4,32	4,38	4,43	4,49	4,54	4,60	4,65	4,71	4,77	4,82	**160**
170	4,88	4,94	5,00	5,05	5,11	5,17	5,23	5,29	5,35	5,41	**170**
180	5,47	5,53	5,59	5,66	5,72	5,78	5,84	5,91	5,97	6,03	**180**
190	6,10	6,16	6,23	6,29	6,36	6,42	6,49	6,55	6,62	6,69	**190**
200	6,75	6,82	6,89	6,96	7,03	7,10	7,17	7,24	7,31	7,38	**200**
210	7,45	7,52	7,59	7,66	7,73	7,81	7,88	7,95	8,03	8,10	**210**
220	8,17	8,25	8,32	8,40	8,47	8,55	8,63	8,70	8,78	8,86	**220**
230	8,93	9,01	9,09	9,17	9,25	9,33	9,41	9,49	9,57	9,65	**230**
240	9,73	9,81	9,89	9,97	10,05	10,14	10,22	10,30	10,39	10,47	**240**
250	10,55										**250**

STEEL F-20

Working sigmas 2100 y 2400 Kg/cm2 Admissible Shear Stress 1350 y 1575 Kg/cm2

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1,19	1,20	1,20	1,21	1,21	1,22	1,22	1,23	1,23	1,24	**20**
30	1,24	1,25	1,25	1,26	1,26	1,27	1,28	1,28	1,29	1,29	**30**
40	1,30	1,31	1,31	1,32	1,33	1,33	1,34	1,35	1,36	1,36	**40**
50	1,37	1,38	1,39	1,40	1,41	1,41	1,42	1,43	1,44	1,45	**50**
60	1,46	1,47	1,48	1,49	1,50	1,51	1,52	1,54	1,55	1,56	**60**
70	1,57	1,58	1,59	1,61	1,62	1,63	1,65	1,66	1,67	1,69	**70**
80	1,70	1,71	1,73	1,74	1,76	1,77	1,79	1,81	1,82	1,84	**80**
90	1,85	1,87	1,89	1,91	1,92	1,94	1,96	1,98	2,00	2,02	**90**
100	2,03	2,05	2,07	2,09	2,11	2,13	2,15	2,18	2,20	2,22	**100**
110	2,24	2,26	2,28	2,31	2,33	2,35	2,37	2,40	2,42	2,45	**110**
120	2,47	2,49	2,52	2,54	2,57	2,59	2,62	2,65	2,67	2,70	**120**
130	2,72	2,76	2,80	2,84	2,89	2,93	2,97	3,02	3,06	3,11	**130**
140	3,15	3,20	3,24	3,29	3,33	3,38	3,43	3,48	3,52	3,57	**140**
150	3,62	3,67	3,72	3,76	3,81	3,86	3,91	3,96	4,01	4,07	**150**
160	4,12	4,17	4,22	4,27	4,33	4,38	4,43	4,49	4,54	4,59	**160**
170	4,65	4,70	4,76	4,81	4,87	4,93	4,98	5,04	5,10	5,15	**170**
180	5,21	5,27	5,33	5,39	5,44	5,50	5,56	5,62	5,68	5,74	**180**
190	5,81	5,87	5,93	5,99	6,05	6,12	6,18	6,24	6,31	6,37	**190**
200	6,43	6,50	6,56	6,63	6,69	6,76	6,82	6,89	6,96	7,03	**200**
210	7,09	7,16	7,23	7,30	7,37	7,43	7,50	7,57	7,64	7,71	**210**
220	7,78	7,85	7,93	8,00	8,07	8,14	8,21	8,29	8,36	8,43	**220**
230	8,51	8,58	8,66	8,73	8,81	8,88	8,96	9,03	9,11	9,19	**230**
240	9,26	9,34	9,42	9,50	9,58	9,65	9,73	9,81	9,89	9,97	**240**
250	10,05										**250**

STEEL F-22

Working sigmas 1375 y 1570 Kg/cm2 Admissible Shear Stress 884 y 1031 Kg/cm2

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1,20	1,20	1,20	1,21	1,21	1,22	1,22	1,23	1,23	1,24	**20**
30	1,24	1,25	1,26	1,26	1,27	1,27	1,28	1,29	1,29	1,30	**30**
40	1,31	1,31	1,32	1,33	1,33	1,34	1,35	1,36	1,37	1,37	**40**
50	1,38	1,39	1,40	1,41	1,42	1,43	1,44	1,45	1,46	1,47	**50**
60	1,48	1,49	1,50	1,51	1,52	1,53	1,55	1,56	1,57	1,58	**60**
70	1,60	1,61	1,62	1,64	1,65	1,66	1,68	1,69	1,71	1,72	**70**
80	1,74	1,75	1,77	1,79	1,80	1,82	1,84	1,85	1,87	1,89	**80**
90	1,91	1,93	1,95	1,96	1,98	2,00	2,02	2,04	2,06	2,09	**90**
100	2,11	2,13	2,15	2,17	2,19	2,22	2,24	2,26	2,28	2,31	**100**
110	2,33	2,36	2,38	2,40	2,43	2,46	2,48	2,51	2,53	2,56	**110**
120	2,59	2,61	2,64	2,68	2,72	2,76	2,81	2,85	2,90	2,94	**120**
130	2,99	3,04	3,08	3,13	3,18	3,22	3,27	3,32	3,37	3,42	**130**
140	3,47	3,52	3,57	3,62	3,67	3,72	3,77	3,82	3,88	3,93	**140**
150	3,98	4,03	4,09	4,14	4,20	4,25	4,31	4,36	4,42	4,47	**150**
160	4,53	4,59	4,64	4,70	4,76	4,82	4,87	4,93	4,99	5,05	**160**
170	5,11	5,17	5,23	5,29	5,36	5,42	5,48	5,54	5,61	5,67	**170**
180	5,73	5,80	5,86	5,92	5,99	6,05	6,12	6,19	6,25	6,32	**180**
190	6,39	6,45	6,52	6,59	6,66	6,73	6,80	6,87	6,94	7,01	**190**
200	7,08	7,15	7,22	7,29	7,36	7,43	7,51	7,58	7,65	7,73	**200**
210	7,80	7,88	7,95	8,03	8,10	8,18	8,25	8,33	8,41	8,48	**210**
220	8,56	8,64	8,72	8,80	8,88	8,96	9,04	9,12	9,20	9,28	**220**
230	9,36	9,44	9,52	9,60	9,69	9,77	9,85	9,94	10,02	10,11	**230**
240	10,19	10,28	10,36	10,45	10,53	10,62	10,71	10,79	10,88	10,97	**240**
250	10,06										**250**

STEEL F-24

Working sigmas 1500 y 1715 Kg/cm2 Admissible Shear Stress 965 y 1126 Kg/cm2

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1,20	1,20	1,21	1,21	1,22	1,22	1,23	1,23	1,24	1,24	**20**
30	1,25	1,25	1,26	1,27	1,27	1,28	1,28	1,29	1,30	1,30	**30**
40	1,31	1,32	1,33	1,33	1,34	1,35	1,36	1,37	1,38	1,38	**40**
50	1,39	1,40	1,41	1,42	1,43	1,44	1,45	1,46	1,47	1,48	**50**
60	1,50	1,51	1,52	1,53	1,54	1,56	1,57	1,58	1,60	1,61	**60**
70	1,62	1,64	1,65	1,67	1,68	1,70	1,71	1,73	1,74	1,76	**70**
80	1,78	1,80	1,81	1,83	1,85	1,87	1,89	1,90	1,92	1,94	**80**
90	1,96	1,98	2,00	2,02	2,05	2,07	2,09	2,11	2,13	2,16	**90**
100	2,18	2,20	2,23	2,25	2,27	2,30	2,32	2,35	2,37	2,40	**100**
110	2,43	2,45	2,48	2,51	2,53	2,56	2,60	2,64	2,69	2,73	**110**
120	2,78	2,83	2,87	2,92	2,97	3,02	3,06	3,11	3,16	3,21	**120**
130	3,26	3,31	3,36	3,41	3,47	3,52	3,57	3,62	3,68	3,73	**130**
140	3,78	3,84	3,89	3,95	4,00	4,06	4,11	4,17	4,23	4,28	**140**
150	4,34	4,40	4,46	4,52	4,58	4,64	4,70	4,76	4,82	4,88	**150**
160	4,94	5,00	5,06	5,13	5,19	5,25	5,32	5,38	5,45	5,51	**160**
170	5,58	5,64	5,71	5,78	5,84	5,91	5,98	6,05	6,11	6,18	**170**
180	6,25	6,32	6,39	6,46	6,53	6,61	6,68	6,75	6,82	6,89	**180**
190	6,97	7,04	7,11	7,19	7,26	7,34	7,41	7,49	7,57	7,64	**190**
200	7,72	7,80	7,87	7,95	8,03	8,11	8,19	8,27	8,35	8,43	**200**
210	8,51	8,59	8,67	8,76	8,84	8,92	9,00	9,09	9,17	9,26	**210**
220	9,34	9,43	9,51	9,60	9,68	9,77	9,86	9,94	10,03	10,12	**220**
230	10,21	10,30	10,39	10,48	10,57	10,66	10,75	10,84	10,93	11,02	**230**
240	11,12	11,21	11,30	11,40	11,49	11,58	11,68	11,77	11,87	11,97	**240**
250	12,06										**250**

STEEL F-26

Working sigmas 1625 y 1857 Kg/cm2 Admissible Shear Stress 1045 y 1219 Kg/cm2

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1,20	1,20	1,21	1,21	1,22	1,22	1,23	1,23	1,24	1,24	**20**
30	1,25	1,26	1,26	1,27	1,28	1,28	1,29	1,30	1,30	1,31	**30**
40	1,32	1,33	1,33	1,34	1,35	1,36	1,37	1,38	1,38	1,39	**40**
50	1,40	1,41	1,42	1,43	1,44	1,46	1,47	1,48	1,49	1,50	**50**
60	1,51	1,53	1,54	1,55	1,56	1,58	1,59	1,61	1,62	1,64	**60**
70	1,65	1,67	1,68	1,70	1,71	1,73	1,75	1,76	1,78	1,80	**70**
80	1,82	1,84	1,86	1,88	1,89	1,91	1,94	1,96	1,98	2,00	**80**
90	2,02	2,04	2,06	2,09	2,11	2,13	2,16	2,18	2,20	2,23	**90**
100	2,25	2,28	2,31	2,33	2,36	2,38	2,41	2,44	2,47	2,49	**100**
110	2,53	2,58	2,62	2,67	2,72	2,77	2,81	2,86	2,91	2,96	**110**
120	3,01	3,06	3,11	3,16	3,21	3,27	3,32	3,37	3,43	3,48	**120**
130	3,53	3,59	3,64	3,70	3,75	3,81	3,87	3,92	3,98	4,04	**130**
140	4,10	4,16	4,22	4,28	4,34	4,40	4,46	4,52	4,58	4,64	**140**
150	4,70	4,77	4,83	4,89	4,96	5,02	5,09	5,15	5,22	5,29	**150**
160	5,35	5,42	5,49	5,55	5,62	5,69	5,76	5,83	5,90	5,97	**160**
170	6,04	6,11	6,19	6,26	6,33	6,40	6,48	6,55	6,62	6,70	**170**
180	6,77	6,85	6,93	7,00	7,08	7,16	7,23	7,31	7,39	7,47	**180**
190	7,55	7,63	7,71	7,79	7,87	7,95	8,03	8,11	8,20	8,28	**190**
200	8,36	8,45	8,53	8,62	8,70	8,79	8,87	8,96	9,05	9,13	**200**
210	9,22	9,31	9,40	9,49	9,57	9,66	9,75	9,85	9,94	10,03	**210**
220	10,12	10,21	10,30	10,40	10,49	10,58	10,68	10,77	10,87	10,96	**220**
230	11,06	11,16	11,25	11,35	11,45	11,55	11,64	11,74	11,84	11,94	**230**
240	12,04	12,14	12,24	12,35	12,45	12,55	12,65	12,76	12,86	12,96	**240**
250	13,07										**250**

STEEL F-30

Working sigmas 1875 y 2143 Kg/cm2 Admissible Shear Stress 1206 y 1407 Kg/cm2

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1,20	1,20	1,21	1,22	1,22	1,23	1,23	1,24	1,24	1,25	**20**
30	1,26	1,26	1,27	1,28	1,28	1,29	1,30	1,30	1,31	1,32	**30**
40	1,33	1,34	1,35	1,36	1,36	1,37	1,38	1,39	1,40	1,41	**40**
50	1,42	1,44	1,45	1,46	1,47	1,48	1,50	1,51	1,52	1,54	**50**
60	1,55	1,56	1,58	1,59	1,61	1,62	1,64	1,66	1,67	1,69	**60**
70	1,71	1,72	1,74	1,76	1,78	1,80	1,82	1,84	1,86	1,88	**70**
80	1,90	1,92	1,95	1,97	1,99	2,01	2,04	2,06	2,09	2,11	**80**
90	2,14	2,16	2,19	2,21	2,24	2,27	2,30	2,32	2,35	2,38	**90**
100	2,41	2,46	2,51	2,56	2,61	2,66	2,71	2,76	2,81	2,87	**100**
110	2,92	2,97	3,03	3,08	3,14	3,19	3,25	3,30	3,36	3,42	**110**
120	3,47	3,53	3,59	3,65	3,71	3,77	3,83	3,89	3,95	4,01	**120**
130	4,08	4,14	4,20	4,27	4,33	4,40	4,46	4,53	4,59	4,66	**130**
140	4,73	4,80	4,86	4,93	5,00	5,07	5,14	5,21	5,28	5,36	**140**
150	5,43	5,50	5,57	5,65	5,72	5,80	5,87	5,95	6,02	6,10	**150**
160	6,18	6,25	6,33	6,41	6,49	6,57	6,65	6,73	6,81	6,89	**160**
170	6,97	7,05	7,14	7,22	7,30	7,39	7,47	7,56	7,64	7,73	**170**
180	7,82	7,90	7,99	8,08	8,17	8,26	8,35	8,44	8,53	8,62	**180**
190	8,71	8,80	8,89	8,99	9,08	9,17	9,27	9,36	9,46	9,55	**190**
200	9,65	9,75	9,84	9,94	10,04	10,14	10,24	10,34	10,44	10,54	**200**
210	10,64	10,74	10,84	10,94	11,05	11,15	11,26	11,36	11,46	11,57	**210**
220	11,68	11,78	11,89	12,00	12,10	12,21	12,32	12,43	12,54	12,65	**220**
230	12,76	12,87	12,98	13,10	13,21	13,32	13,44	13,55	13,66	13,78	**230**
240	13,90	14,01	14,13	14,25	14,36	14,48	14,60	14,72	14,84	14,96	**240**
250	15,08										**250**

STEEL F-36

Working sigmas 2250 y 2571 Kg/cm2 Admissible Shear Stress 1447 y 1688 Kg/cm2

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1,20	1,21	1,21	1,22	1,23	1,23	1,24	1,24	1,25	1,26	**20**
30	1,26	1,27	1,28	1,29	1,29	1,30	1,31	1,32	1,33	1,34	**30**
40	1,35	1,36	1,37	1,38	1,39	1,40	1,41	1,42	1,43	1,45	**40**
50	1,46	1,47	1,48	1,50	1,51	1,53	1,54	1,56	1,57	1,59	**50**
60	1,61	1,62	1,64	1,66	1,68	1,70	1,72	1,74	1,76	1,78	**60**
70	1,80	1,82	1,84	1,86	1,89	1,91	1,93	1,96	1,98	2,01	**70**
80	2,04	2,06	2,09	2,12	2,14	2,17	2,20	2,23	2,26	2,29	**80**
90	2,34	2,40	2,45	2,50	2,56	2,61	2,67	2,72	2,78	2,84	**90**
100	2,89	2,95	3,01	3,07	3,13	3,19	3,25	3,31	3,38	3,44	**100**
110	3,50	3,57	3,63	3,70	3,76	3,83	3,90	3,96	4,03	4,10	**110**
120	4,17	4,24	4,31	4,38	4,45	4,52	4,60	4,67	4,74	4,82	**120**
130	4,89	4,97	5,04	5,12	5,20	5,28	5,35	5,43	5,51	5,59	**130**
140	5,67	5,76	5,84	5,92	6,00	6,09	6,17	6,26	6,34	6,43	**140**
150	6,51	6,60	6,69	6,78	6,87	6,95	7,05	7,14	7,32	7,32	**150**
160	7,41	7,50	7,60	7,69	7,79	7,88	7,98	8,07	8,17	8,27	**160**
170	8,37	8,46	8,56	8,66	8,76	8,87	8,97	9,07	9,17	9,28	**170**
180	9,38	9,48	9,59	9,69	9,80	9,91	10,02	10,12	10,23	10,34	**180**
190	10,45	10,56	10,67	10,78	10,90	11,01	11,12	11,23	11,35	11,46	**190**
200	11,58	11,70	11,81	11,93	12,05	12,17	12,28	12,40	12,52	12,65	**200**
210	12,77	12,89	13,01	13,13	13,26	13,38	13,51	13,63	13,76	13,88	**210**
220	14,01	14,14	14,27	14,40	14,53	14,66	14,79	14,92	15,05	15,18	**220**
230	15,31	15,45	15,58	15,72	15,85	15,99	16,12	16,26	16,40	16,54	**230**
240	16,67	16,81	16,95	17,09	17,24	17,38	17,52	17,66	17,80	17,95	**240**
250	18,09										**250**

STEEL A-37

Working sigmas 1600 y 1800 Kg/cm2 Admissible Shear Stress 1029 y 1182 Kg/cm2

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1,01	1,02	1,02	1,02	1,02	1,02	1,02	1,03	1,03	1,03	**20**
30	1,03	1,04	1,04	1,04	1,05	1,05	1,05	1,06	1,06	1,06	**30**
40	1,07	1,07	1,08	1,08	1,08	1,09	1,09	1,10	1,10	1,11	**40**
50	1,12	1,12	1,13	1,14	1,14	1,15	1,16	1,17	1,17	1,18	**50**
60	1,19	1,20	1,21	1,22	1,23	1,24	1,25	1,26	1,28	1,29	**60**
70	1,30	1,31	1,33	1,34	1,36	1,37	1,39	1,40	1,42	1,44	**70**
80	1,45	1,47	1,49	1,51	1,53	1,55	1,57	1,59	1,61	1,63	**80**
90	1,65	1,67	1,70	1,72	1,74	1,77	1,79	1,82	1,84	1,87	**90**
100	1,89	1,92	1,95	1,97	2,00	2,03	2,06	2,09	2,12	2,15	**100**
110	2,18	2,21	2,24	2,27	2,30	2,33	2,37	2,40	2,43	2,47	**110**
120	2,50	2,53	2,57	2,60	2,64	2,68	2,71	2,75	2,78	2,82	**120**
130	2,86	2,90	2,94	2,97	3,01	3,05	3,09	3,13	3,17	3,21	**130**
140	3,25	3,29	3,33	3,38	3,42	3,46	3,50	3,55	3,59	3,63	**140**
150	3,68	3,72	3,77	3,81	3,86	3,90	3,95	4,00	4,04	4,09	**150**
160	4,14	4,18	4,23	4,28	4,33	4,38	4,43	4,48	4,53	4,58	**160**
170	4,63	4,68	4,73	4,78	4,83	4,88	4,94	4,99	5,04	5,09	**170**
180	5,15	5,20	5,26	5,31	5,36	5,42	5,48	5,53	5,59	5,64	**180**
190	5,70	5,76	5,81	5,87	5,93	5,99	6,05	6,11	6,16	6,22	**190**
200	6,28	6,34	6,40	6,46	6,53	6,59	6,65	6,71	6,77	6,84	**200**
210	6,90	6,96	7,03	7,09	7,15	7,22	7,28	7,35	7,41	7,48	**210**
220	7,54	7,61	7,67	7,74	7,81	7,88	7,94	8,01	8,08	8,15	**220**
230	8,22	8,29	8,36	8,43	8,49	8,57	8,64	8,71	8,78	8,85	**230**
240	8,92	8,99	9,07	9,14	9,21	9,29	9,36	9,43	9,51	9,58	**240**
250	9,66										**250**

STEEL A-42

Working sigmas 1730 y 1950 Kg/cm2 Admissible Shear Stress 1113 y 1280 Kg/cm2

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1,02	1,02	1,02	1,02	1,02	1,03	1,03	1,03	1,03	1,04	**20**
30	1,04	1,04	1,04	1,05	1,05	1,05	1,06	1,06	1,07	1,07	**30**
40	1,07	1,08	1,08	1,09	1,09	1,10	1,10	1,11	1,12	1,12	**40**
50	1,13	1,14	1,14	1,15	1,16	1,17	1,18	1,19	1,20	1,21	**50**
60	1,22	1,23	1,24	1,25	1,26	1,27	1,29	1,30	1,31	1,33	**60**
70	1,34	1,36	1,37	1,39	1,40	1,42	1,44	1,46	1,47	1,49	**70**
80	1,51	1,53	1,55	1,57	1,60	1,62	1,64	1,66	1,69	1,71	**80**
90	1,74	1,76	1,79	1,81	1,84	1,86	1,89	1,92	1,95	1,98	**90**
100	2,01	2,03	2,06	2,09	2,13	2,16	2,19	2,22	2,25	2,29	**100**
110	2,32	2,35	2,39	2,42	2,46	2,49	2,53	2,56	2,60	2,64	**110**
120	2,67	2,71	2,75	2,79	2,82	2,86	2,90	2,94	2,98	3,02	**120**
130	3,06	3,11	3,15	3,19	3,23	3,27	3,32	3,36	3,40	3,45	**130**
140	3,49	3,54	3,58	3,63	3,67	3,72	3,77	3,81	3,86	3,91	**140**
150	3,96	4,00	4,05	4,10	4,15	4,20	4,25	4,30	4,35	4,40	**150**
160	4,45	4,51	4,56	4,61	4,66	4,72	4,77	4,82	4,88	4,93	**160**
170	4,99	5,04	5,10	5,15	5,21	5,26	5,32	5,38	5,44	5,49	**170**
180	5,55	5,61	5,67	5,73	5,79	5,85	5,91	5,97	6,03	6,09	**180**
190	6,15	6,21	6,27	6,34	6,40	6,46	6,53	6,59	6,65	6,72	**190**
200	6,78	6,85	6,91	6,98	7,05	7,11	7,18	7,25	7,31	7,38	**200**
210	7,45	7,52	7,59	7,66	7,72	7,79	7,86	7,93	8,01	8,08	**210**
220	8,15	8,22	8,29	8,36	8,44	8,51	8,58	8,66	8,73	8,80	**220**
230	8,88	8,95	9,03	9,11	9,18	9,26	9,33	9,41	9,49	9,57	**230**
240	9,64	9,72	9,80	9,88	9,96	10,04	10,12	10,20	10,28	10,36	**240**
250	10,44										**250**

STEEL A-52

Working Sigmas 2400 y 2700 Kg/cm2 Admissible Shear Stress 1543 y 1772 Kg/cm2

λ	0	1	2	3	4	5	6	7	8	9	λ
20	1,02	1,02	1,03	1,03	1,03	1,04	1,04	1,04	1,05	1,05	**20**
30	1,05	1,06	1,06	1,07	1,07	1,08	1,08	1,09	1,10	1,10	**30**
40	1,11	1,12	1,13	1,13	1,14	1,15	1,16	1,17	1,18	1,19	**40**
50	1,20	1,22	1,23	1,24	1,25	1,27	1,28	1,30	1,31	1,33	**50**
60	1,35	1,37	1,39	1,41	1,43	1,45	1,47	1,49	1,51	1,54	**60**
70	1,56	1,59	1,61	1,64	1,66	1,69	1,72	1,75	1,78	1,81	**70**
80	1,84	1,87	1,90	1,94	1,97	2,01	2,04	2,08	2,11	2,15	**80**
90	2,18	2,22	2,26	2,30	2,34	2,38	2,42	2,46	2,50	2,54	**90**
100	2,59	2,63	2,67	2,72	2,76	2,81	2,85	2,90	2,95	2,99	**100**
110	3,04	3,09	3,14	3,19	3,24	3,29	3,34	3,39	3,44	3,49	**110**
120	3,55	3,60	3,65	3,71	3,76	3,82	3,87	3,93	3,98	4,04	**120**
130	4,10	4,16	4,22	4,27	4,33	4,39	4,45	4,52	4,58	4,64	**130**
140	4,70	4,76	4,83	4,89	4,95	5,02	5,08	5,15	5,22	5,28	**140**
150	5,35	5,42	5,48	5,55	5,62	5,69	5,76	5,83	5,90	5,97	**150**
160	6,04	6,12	6,19	6,26	6,34	6,41	6,48	6,56	6,63	6,71	**160**
170	6,79	6,86	6,94	7,02	7,09	7,17	7,25	7,33	7,41	7,49	**170**
180	7,57	7,65	7,73	7,82	7,90	7,98	8,07	8,15	8,24	8,32	**180**
190	8,40	8,49	8,58	8,66	8,75	8,84	8,93	9,02	9,10	9,19	**190**
200	9,28	9,37	9,47	9,56	9,65	9,74	9,83	9,92	10,02	10,11	**200**
210	10,21	10,30	10,40	10,49	10,59	10,69	10,78	10,88	10,98	11,08	**210**
220	11,18	11,27	11,38	11,48	11,57	11,86	11,78	11,88	11,98	12,09	**220**
230	12,19	12,29	12,40	12,50	12,61	12,72	12,82	12,93	13,03	13,14	**230**
240	13,25	13,36	13,47	13,58	13,69	13,80	13,91	14,02	14,13	14,25	**240**
250	14,36										**250**

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